ACANTHUS

An international newsletter to encourage interest in the Acanthaceae

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Anisophylly in Acanthaceae

In Kew Bull. 40: 788 (1988) I described a new species of *Isoglossa* with very markedly unequal leaves in each pair as *I. anisophylla*. The species is confined to north-eastern Tanzania where it occurs mostly in evergreen forest. I noted then a few other examples of anisophylly in Acanthaceae in other parts of the world. Since then, the discovery of two species of *Justicia* which are similarly anisophyllous, and which occur in the same habitat in the same part of Tanzania as the *Isoglossa* (Brummitt in Kew Bull., in press), has increased my interest in this phenomenon. With the help of various others working with this family I have brought together the following list of anisophyllous Acanthaceae, but there are probably more names yet to be added.

From Africa, Kaj Vollesen draws my attention to the genus *Sclerochiton* Harv., with about 15 to 20 species characteristic of various types of forest and all more or less anisophyllous, with the extreme in *S. bequaertii* De Wild. from Uganda and Zaire where one leaf is long and narrowly elliptic and the other small and suborbicular. Henk Beentje comments that *S. holstii* (Lindau) C.B. Cl. occurs in coastal and subcoastal forest and woodland in Kenya and Tanzania, overlapping conspicuously with the distributions of the *Isoglossa* and two *Justicia* species referred to above. Significantly also, *J. campylostemon* T. Anders., which is closely related to the same two *Justicia* species and also occurs in low altitude subcoastal forest, but in Transvaal, Swaziland, Natal and eastern Cape Province, shows the same character. Kevin Balkwill draws attention to a tendency to unequal leaves in *Dicliptera zeylanica* Nees, a forest species, in South Africa, and in several other *Dicliptera* species of more open habitats in South Africa. I have noticed marked anisophylly also in *Ruellia primuloides* (T. Anders. ex Benth.) Heine, a forest species in western Africa from Sierra Leone to Gabon; in *Barleria matopensis* S. Moore, a species of evergreen forest or woodland usually on river banks in south tropical Africa; in specimens currently referred to *Hypoestes consanguinea* Lindau from forests of Burundi and the Imatong Mountains of Sudan; and in *Hypoestes phyllostachya* Bak. from forests of Madagascar (often cultivated as a house plant). The anisophylly in *Blepharis* to which I referred in my *Isoglossa* note is of a slightly different kind, where the leaves are in equal pairs but with two unequal pairs at each node (compare with a slightly different situation in *Holographis* noted below). A further variant is noted by Mikael Hedrén in *Justicia* sect. *Harnieria* and sect. *Tyloglossa* where the foliage leaves are equal but the inflorescence bracts may be very unequal, as for example in *H. metallorum* Duvign.

From the tropical Asian region my *Isoglossa* note already mentioned *Ancylacanthus cyrtandroides* Lindau, to which may now be added *Leptosiphonium papuanum* (S. Moore) Bremek., both from forests of New Guinea. Perhaps more significant is the genus *Hallieracantha* Stapf, with perhaps about 30 species apparently confined to Borneo and the Phillipines, in which over half the species are anisophyllous (see, for example, Stapf in J. Linn. Soc., Bot. 38: 6-17, 1907) and the smaller leaf is often so reduced as to be almost lacking altogether so that the plant appears alternate-leaved. The genus is again largely confined to forest understories. Bertel Hansen informs me that both *Ancylacanthus* and *Hallieracantha* may perhaps be best regarded as congeneric with *Polytrema vulgare* C.B. Cl. from forests of the Malay-Indochina peninsula, which varies from being very

strongly anisophyllous (with one leaf almost absent) to quite normally isophyllous, even within Thailand. A similar extreme reduction of one leaf in each pair is often found also in *Strobilanthes anisophyllus* (Nees) T. Anders. from the forest of Assam, and it is interesting to note C.B. Clarke's observations (Fl. Brit. Is. 4(2): 462-463, 1884) that this species is otherwise so similar to *S. isophyllus* (Nees) T. Anders. that the latter (known to him only from cultivation) might be only a cultivated reversionary form of *S. anisophyllus*. Numerous other species of *Strobilanthes sensu lato* show a similar tendency. From the Phillipines *Justicia dispar* Merrill and *J. loheri* C.B. Cl. are further examples, while from the forests of New Guinea *J. cardiochlamys* Lindau and *J. chalmersii* Lindau also have very markedly unequal leaves.

In Australia, anisophylly is known in *Pseuderanthemum tenellum* (Benth.) Domin from Queensland, as Robyn Barker points out to me.

From Central America the genus *Holographis*, revised by Tom Daniel (J. Arnold Arbor. 64: 129-160, 1983; see also Proc. Calif. Acad. Sci. 46: 73-81, 1988), has 15 species, all confined to Mexico, in most of which the leaves appear to be in whorls of four. In *H. anisophylla* T.F. Daniel, known only from two collections from tropical deciduous forest in Jalisco and Colima (T. Daniel, pers. comm.), one of the four leaves is very reduced and another is conspicuously narrower than the other two (Daniel 1983, l.c., Fig. 4); *H. pallida* Leonard & Gentry, from similar habitat in Sonora and Sinaloa, is said to be very similar in leaves; while *H. ehrenbergiana* Nees, widespread in arid and semi-arid habitats in Mexico, seems often to have one of the four leaves conspicuously bigger than the other three (Daniel 1983, l.c., Fig. 6). Gibson (Fieldiana, Bot. 24(10): 419, 1974) characterises all four species of *Poikilacanthus* which occur in Guatemala, all in wet forest, as being anisophyllous, but the same is not true of the South American representatives of this genus.

In the West Indies the six species of the peculiar spiny genus *Barleriola* Oerst., endemic to Cuba and Hispaniola, are all anisophyllous.

In South America, a number of examples are centred on Peru or adjacent areas where they are inhabitants of margins of rain-forest. Several species of *Sanchezia* such as *S. punicea* Leonard & L.B. Smith, *S. skutchii* Leonard, *S. oxysepala* Mildbr. and *S. scandens* (Lindau) Leonard, all from Peru, exhibit marked anisophylly, as also do their closely allied neighbours *Sussenguthia leucerythra* (Leonard & L.B. Smith) Wassh. and *S. vargasii* Wassh. In the same region are *Hansteinia crenulata* Britton, *Stenostephanus thyrsoides* Lindau and *Pseuderanthemum bolivianum* Britton with the same characteristic. *Justicia rizzinii* Wassh., now becoming increasingly known in cultivation, is another conspicuous example, but from southeastern Brazil, while *J. luschnathii* Lindau from the restinga (dry evergreen forest) of Bahia Province of Brazil often has one leaf completely suppressed. Dieter Wasshausen also draws my attention to the phenomenon in *Bravaisia integerrima* (Spreng.) Standl. from Venezuela to Panama and the related *Trichanthera gigantea* (Humb. & Bonpl.) Nees from Amazonian Brazil and Guyana, in *Lophostachys floribunda* Pohl from northeastern Brazil, *Aphelandra pulcherrima* (Jacq.) Kunth from Colombia, *Anisacanthus secundus* Leonard from Venezuela and *Pseuderanthemum riedelianum* (Nees) Rizzini from southeastern Brazil. John Wood has described *Justicia disparifolia* (Kew Bull. 43: 46. 1988) from dry riverine forest in Colombia, and he also observes that E. C. Leonard (Contr. U.S. Natl. Herb. 31: 729. 1958) keyed out *Pseuderanthemum chilianthum* Leonard and *P. diachylum* Leonard from Colombia on the basis of their unequal leaves.

While no obvious selection pressure suggests itself to account for anisophylly occurring in these different genera of Acanthaceae, one can at least point to the fact that nearly all species exhibiting it are inhabitants of evergreen forest understory or margins, and certain areas appear to have a higher incidence of the phenomenon in this family than have other areas. Furthermore, although in some cases it is known in taxonomically isolated occurrences, it may also be common to groups of closely related species or recur more than once in a genus or group of related genera. No doubt other examples will come to light in the family, and I should be interested to receive more information. Comparisons with other opposite-leaved families might also be instructive, such as Melastomataceae which, as correspondents have already commented to me, shows a high incidence of anisophylly in the forests of Borneo and South America which are particularly noted above in connection with Acanthaceae. And anybody reviewing the phenomenon generally should look at the Malesian *Lycianthes parasitica* (Bl.) Bitter in Solanaceae, a normally alternate-leaved family, pointed out to me by Sally Bidgood.

My thanks are due to Kevin Balkwill, Robyn Barker, Henk Beentje, Sally Bidgood, Tom Daniel, Vicky Graham, Bertel Hansen, Mikael Hedrén, Kathy Immelman, Kaj Vollesen, Dieter Wasshausen, and John Wood for much interesting correspondence on this matter. I will hope for further examples from other Acanthologists. When you get your eye in for anisophylly, it is surprising how you keep noticing it in unexpected places.

-R. K. Brummitt

Graham, V. A. W. 1988. Delimitation and infra-generic classification of *Justicia* (*Acanthaceae*). Kew Bull. 43: 551-624.

Much good research has been buried on the shelves of university libraries in unpublished theses. It is most encouraging that V. Graham has carried through to publication the most important parts of her thesis. Being the largest genus in the Acanthaceae with about 600 species, *Justicia* was in the past segregated into a multitude of genera, some of them so badly circumscribed that their authors did not recognize them a few years after publication. In the present work, the author studied 295 species from all parts of the distribution area, thereby giving the first modern comparison of species on a larger scale of this pantropical genus. The species selected for study were chosen to cover all segregate genera reasonably well. A rough survey by the reviewer showed that 161 American, 82 African, 43 Asian, 9 Madagascan, 3 Australian, and 1 Pacific species were studied.

By using general morphological techniques, characters of inflorescence, androecium, pollen, and seeds proved to be particularly helpful in delimiting 16 sections and 7 subsections. Of particular nomenclatural importance are the 69 new specific names published. The detailed analysis of each specimen comprised the morphology of inflorescences, bracts and bracteoles, calyx, corolla, androecium, pollen, and fruit and seeds without *a priori* weighting. A numerical analysis assisted in the objective assessment of results. The numerical analysis is not treated further in this paper. One could well imagine that it resulted in partly meaningless classifications, as most computer aided classification systems do. In many of the sections a list of "peripheral species" is given, probably as a result of this. An interesting conclusion is drawn on the distribution of inflorescence-types. Dichasial inflorescences are confined to the Old World, simple spicate inflorescences with one or two flowers per node are found in both hemispheres, and compound spicate inflorescences are in the New World only. However, the reviewer can hardly interpret the inflorescence of *Justicia kampotiana* from the Indochinese Peninsula other than compound spicate. Bracts and bracteoles vary from triangular or subulate to ovate or cordate and even orbicular. Scarious margins were found in a few species only, e.g., *J. modesta*. The reviewer has studied most of the material available of *J. modesta* and never found scarious margins. A misunderstanding (misidentification) must have crept in here. A great variation was found in the morphology of the androecium. A unique "connective remnant" was found in *J. glazionii*. The reviewer has noted this to a much lesser extent in some Asian species. The pollen morphology is well described and a most welcome key to the types is provided. Ripe fruits with rising placentas were found only in the South American section *Leucoloma* and in *J. gendarussa*. The author maintains that in *J. gendarussa* the walls do not split, contrary to what is seen in *Rungia* fruits. This is not correct. In *J. gendarussa* and in the closely related *J. modesta*, *J. subcoriacea*, and *J. ventricosa* the reviewer found occasionally splitting walls, but the character is not constant. Seeds of *Justicia* may be more or less compressed, but a way of measuring the degree of compression is not given. The testa morphology is well described and illustrated. Twenty types in three main groups are recognized. A key would have been welcome.

Finally a few comments will be given to the taxonomic part. Section *Rhaphidospora* should probably be divided into at least two subsections, one containing the closely related *J. amherstia*, *J. gendarussa*, *J. modesta*, *J. subcoriacea*, and *J. ventricosa*. *Leptostachya* Nees is here lectotypified by *L. virgata* Nees (*J. virgata* (Nees) T. Anders.). However, *Leptostachya* was recognized as a genus of its own by the reviewer and lectotypified by *L. wallichii* Nees (see Nord. J. Bot. 5: 469-473. 1985). *Justicia montana* (Nees) T. Anders. is a later homonym of *J. montana* Roxb. and must become *J. santapaui* Bennet. *Justicia salicifolia* T. Anders. is a later homonym of *J. salicifolia* Bl. In the reviewer's opinion, it is best reduced to a synonym of *J. quadrifaria* (Nees) T. Anders. *Justicia leucostachya* (Bremek.) V. Graham is misplaced in sect. *Rostellaria* as also the heading "peripheral species" hints. Probably it fits much better in sect. *Rhaphidospora*, but the inflorescence is certainly difficult to interpret.

The author ends her introductory chapter with the quite realistic suggestion that future studies of the remaining species of *Justicia* might call for a revision of her present sectional classification. It is hoped that she will find time and means to carry on with the study of *Justicia* to the benefit of all of us who struggle with floristic treatments of the Acanthaceae in various parts of the world.

- Bertel Hansen

Graham, V. A. W. 1988. Delimitation and infra-generic classification of *Justicia (Acanthaceae)*. Kew Bull. 43: 551-624.

Justicia is the largest genus of Acanthaceae and taxonomically the most complex. Recent estimates of the number of species of *Justicia* vary from about 420 (Mabberley, D. J. *The Plant Book*. 1987.) to about 600 (*fide* Graham). A trend of the past several decades has been to include many traditionally recognized, but inadequately defined, genera within *Justicia*. The resultant taxon has itself become difficult to define and one wonders how the numerous genera of Bremekamp's Justicieae (Bull. Bot. Surv. India 7: 21-30. 1965) can be maintained as distinct.

Because of its unwieldy size and complexity no one has been willing to tackle a systematic revision of *Justicia* in its entirety. Graham, however, has made an admirable attempt to bring some order to the chaos of infrageneric classification of the genus. Hansen (see above) describes the extent and methods of her study. Because only 58 species were studied in detail, Graham rightly concludes that it would be overly optimistic to presume that species not studied by her will all fit into the classification she proposes. Indeed, the first three species of *Justicia* that I have studied since publication of Graham's classification suggest the need for some revisions in it. Using Graham's key to sections and subsections, a new species from México "keys" closest to section *Betonica* subsection *Anisostachya*, a taxon confined to Madagascar and tropical Africa. It is clear from the description of section *Betonica* that the new species does not belong there, however. The new species from Mexico has pollen identical to that described by Graham for sections *Justicia* (Africa and the Canary Islands) and *Leucoloma* (Paraguay and Brazil). The relatives of this species are therefore not readily evident. Another species from México, originally described as *Beloperone adenothyrsa* Lindau, "keys" to (or near) section *Sarotheca*. It differs in minor characters from her description of that section (e.g., bracts not subulate and shorter than calyx and corolla neither pink to purple nor greenish-yellow) but agrees in the diagnostic features of the inflorescence, calyx, and seeds. Graham describes pollen like that of *Beloperone adenothyrsa* as "type 7." She notes that section *Sarotheca* has "type 6" pollen or pollen intermediate between "type 6" and "type 7." The related section *Plagiacanthus* has "type 7" pollen but *Beloperone adenothyrsa* does not fit into this section with respect to the macromorphological characters noted above. A new species from Panamá with "type 5" pollen (which occurs in 5 sections recognized by Graham) is not identifiable with any subgeneric taxa using the keys and descriptions.

Graham notes that a primary task of her study was to establish whether *Justicia* is best maintained in a broad sense or divided into segregate genera. Her conclusion is unquestionably the former and, in fact, she expands the genus to include several others for the first time (e.g., *Averia* Leonard, *Chaetochlamys* Lindau, *Chaetothylax* Nees, *Siphonoglossa* Oerst.). Some of these are undoubtedly indistinguishable from *Justicia* in a broad sense. Inclusion of others could have a domino effect within the Justicieae. For example, *Averia* has been treated as a taxonomic synonym of the larger genus *Tetramerium* Nees (Syst. Bot. Monogr. 12: 1-134. 1986.). If *Tetramerium* were to be included in *Justicia*, none of its close relatives in the Justicieae subtribe Odontoneminae (e.g., *Anisacanthus* Nees, *Aphanosperma* Daniel, *Carlowrightia*, A. Gray, *Gypsacanthus* Lott et al., *Henrya* Benth., *Mexacanthus* Daniel, *Mirandea* Rzedowski, *Yeatesia* Small) could be excluded. Other neotropical genera that might justifiably be placed in *Justicia*, but not addressed by Graham, include *Ixtlania* M. Jones, *Neohallia* Hemsley, *Spathacanthus* Baillon, and *Tabascina* Baillon.

One might argue that the creation of many new and random combinations in *Justicia* is somewhat premature. For example, the genus *Siphonoglossa*, synonymized by Graham into section *Chaetothylax*, consists of some 20 species from America and Africa. A combination in *Justicia* is made for only one (albeit the type) of these species. At least one of the new combinations for American taxa is superfluous; the combination in *Justicia* for *Adhatoda candicans* Nees was correctly and previously made by Benson (*Trees and Shrubs of the Southwestern Deserts*. 218. 1981.)

The most frustrating aspect of this kind of study is the superficial survey of taxa. However, within the limits of a Ph.D. project, little more can be expected. Graham has adequately pointed out the limitations of her study. She is to be congratulated for having the courage to undertake an onerous project and the fortitude to see it through to publication. She provides much information and a classification that can be augmented and refined. Her goal of providing a framework for future study of *Justicia* has been very nicely accomplished.

- T. F. Daniel